



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(71) Applicant (for all designated States except US): SMART-MOVE, NAAMLOZE VENNOOTSCHAP [BE/BE]; Vanden Tymplestraat 33, B-3000 Leuven (BE).

(72) Inventor; and

(75) Inventor/Applicant (for US only): BUYTAERT, Steven, Herwig, Cyriel [BE/BE]; Kesseldallaan 91 bus 11, B-3010 Kessel-Lo (BE).

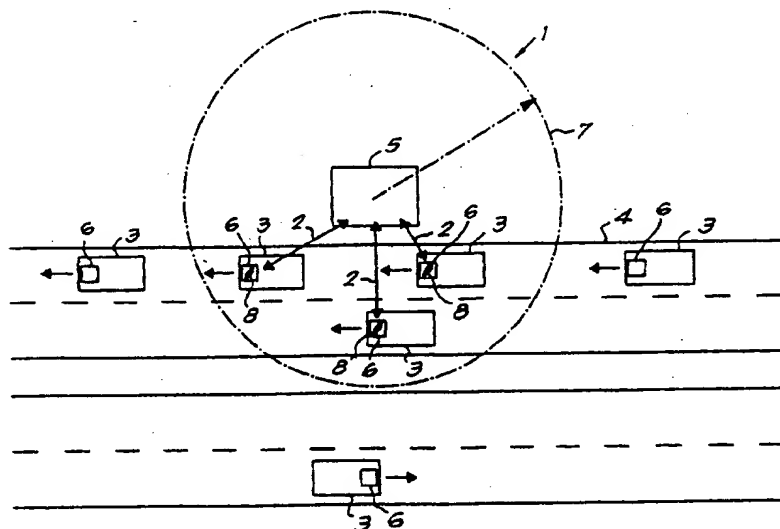
(74) Agent: DONNE, Eddy; Bureau M.F.J. Bockstael N.V., Arenbergstraat 13, B-2000 Antwerpen (BE).

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(54) Title: METHOD AND DEVICE FOR ESTABLISHING A WIRELESS COMMUNICATION BETWEEN VEHICLES AND COMMUNICATION EQUIPMENT ERECTED ALONG THE ROAD



## (57) Abstract

Method for establishing a wireless communication between vehicles and communication equipment erected along the road, in particular a communication (2) between one or several modules (6) provided to the respective vehicles (3) and communication equipment (5) along the road (4), characterized in that use is made for the communication (2) of the "direct sequence spread spectrum" principle, also called the "direct access broad spectrum" principle, whereby several modules (6) of such vehicles (3) can simultaneously communicate with the above-mentioned communication equipment (5) on one and the same frequency band, and whereby each communicating module (6) is distinguished from the other ones to this end on the basis of an allotted code (8).

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Method and device for establishing a wireless  
5 communication between vehicles and communication  
equipment erected along the road.

The present invention concerns a method and a device for  
establishing a wireless communication between vehicles  
10 and communication equipment along the road.

The invention is designed in the first place for  
exchanging data between a vehicle and a transmitting  
station and/or receiving station along the road, among  
15 others data related to toll driving.

Systems for exchanging data between vehicles and  
communication equipment along the road are already known,  
but these known systems are little suitable for toll  
20 driving, as they cannot transmit the data concerned with  
sufficient certainty in the often short time available.

Also, the present invention concerns a method and device  
for establishing such a communication which does not have  
25 the above-mentioned disadvantage, in other words which  
allow for a two-way communication which, even with a  
transmission and receiving range extending over a very  
short distance, for example a few metres, makes it  
possible to have a very reliable data exchange between a  
30 module in a car, in particular a riding car, and  
receiving equipment erected along the road in a very  
short time.

To this end, the invention in the first place concerns a

method for establishing a wireless communication between vehicles and communication equipment erected along the road, in particular a communication between one or several modules provided to the respective vehicles and communication equipment along the road, characterized in that use is made for the communication of the "direct sequence spread spectrum" principle, also called the "direct access broad spectrum" principle, whereby several modules of such vehicles can simultaneously communicate with the above-mentioned communication equipment on one and the same frequency band, and whereby each communicating module is distinguished from the other ones to this end on the basis of an allotted code.

15 The use of what is called the "direct sequence spread centrum" principle, offers the advantage that a large number of communication links can be simultaneously established with the modules of several passing vehicles. Another major advantage of applying the "direct sequence spread centrum" principle for such a communication consists in that a good communication can be established with very great certainty, in other words a communication whereby all the required information is transmitted, even when the vehicles pass at a very high speed and thus are situated within the range of the equipment used for merely some tenths of a second. The data to be transmitted are coded very redundantly by means of the above-mentioned code, so that even a partial loss of the transmission is compensated by the redundancy of the data.

30

Preferably, a two-way communication is established to this end.

Further, for the above-mentioned code is preferably used what is called a pseudo arbitrary code.

According to the most preferred embodiment, use is made of what is called the "DSRC microwave band" for the above-mentioned frequency band, which is situated at about 5.8 Gigahertz.

According to the most preferred embodiment, also the content of the communication will be secured, in particular by cryptographically transforming it so as to allow for authentication of the source and/or encryption of the data.

According to a particular embodiment, the communication equipment along the road will be mobile, in particular it will be equipment which can be moved and/or wheeled, so that it can be easily used in different places.

Further, the invention also concerns a device for realizing the above-mentioned method, characterized in that it consists of the combination of a multiple of modules which are to be build in and/or are built in respectively in vehicles on the one hand, and communication equipment which is erected and/or can be erected along the road on the other hand, whereby these modules and this communication equipment is provided with electronics which make it possible for the communication equipment to communicate with the modules situated within the transmission and receiving range of said communication equipment by means of a wireless connection at short distance, such by means of a communication making use of the "direct sequence spread centrum" principle, also called "direct access broad spectrum"

principle.

In order to better explain the characteristics of the invention, the following preferred embodiment is described as an example only without being limitative in any way, with reference to the sole accompanying drawing, which schematically represents a device according to the invention, applied for toll driving.

10 As is represented in the accompanying figure, the invention concerns a device 1 for establishing a wireless communication, in particular a two-way communication 2, between vehicles 3 which are situated on a road 4, and communication equipment 5 which is erected along the road  
15 4, for example on the side thereof.

The two-way communication 2 is hereby carried out by means of modules 6 which are provided to this end in the vehicles 3.

20

The invention is special in that, on condition that the necessary electronics are provided in the communication equipment 5 and in the modules 6, a communication 2 is established with every vehicle 3, making use of the  
25 "direct sequence spread spectrum" principle, also called the "direct access broad spectrum" principle, whereby all modules 6 situated within the range 7 of the transmission and receiving equipment used hereby, can communicate with the above-mentioned communication equipment 5 on one and  
30 the same frequency band, as every communicating module 6 is distinguished from another one on the basis of the allotted code 8.

The use of the "direct sequence spread spectrum"

principle allows for a very solid communication. As is known, data are hereby transmitted in such a digitized manner that even when interferences occur whereby certain digits are lost, the transmitted data can still be perceived with great if not complete certainty, so that no second attempt has to be made to communicate, as is the case with other systems known until now which are used to establish communication links between riding vehicles and a beacon or such along the road.

Thanks to the fact that a reliable communication can always be established as of the first request according to the invention, the necessary data can be transmitted in a very short time, so that also very fast vehicles 3, which are merely present within the range 7 for a fraction of a second, can be intercepted in the case of toll driving.

Moreover, by allotting a pseudo arbitrary code 8 to the different modules 6 as mentioned above, the different modules can be easily distinguished, in other words can be easily identified.

As mentioned above, it is clear that the invention both concerns the method used hereby as the whole of components for realizing said method.

It is clear that the above-mentioned modules 6 are not necessarily independent units which are built in in the vehicles 3, but that they can also be electronic circuits which are part of the onboard computer or such of the vehicles 3 concerned.

The present invention is by no means limited to the

embodiment described as an example and represented in the drawing; on the contrary, such a method and device for establishing such a wireless communication can be made according to several variants while still remaining  
5 within the scope of the invention.



Claims.

5

1. Method for establishing a wireless communication between vehicles and communication equipment erected along the road, in particular a communication (2) between one or several modules (6) provided to the respective  
10 vehicles (3) and communication equipment (5) along the road (4), characterized in that use is made for the communication (2) of the "direct sequence spread spectrum" principle, also called the "direct access broad spectrum" principle, whereby several modules (6) of such  
15 vehicles (3) can simultaneously communicate with the above-mentioned communication equipment (5) on one and the same frequency band, and whereby each communicating module (6) is distinguished from the other ones to this end on the basis of an allotted code (8).

20

2. Method according to claim 1, characterized in that a two-way communication (2) is established by means of the above-mentioned principle.

25

3. Method according to claim 1 or 2, characterized in that for the above-mentioned code (8) is used what is called a pseudo arbitrary code.

30

4. Method according to any of the preceding claims, characterized in that for the above-mentioned frequency band, use is made of what is called the "DSRC microwave band", which is situated at about 5.8 Gigahertz.

5. Method according to any of the preceding claims,

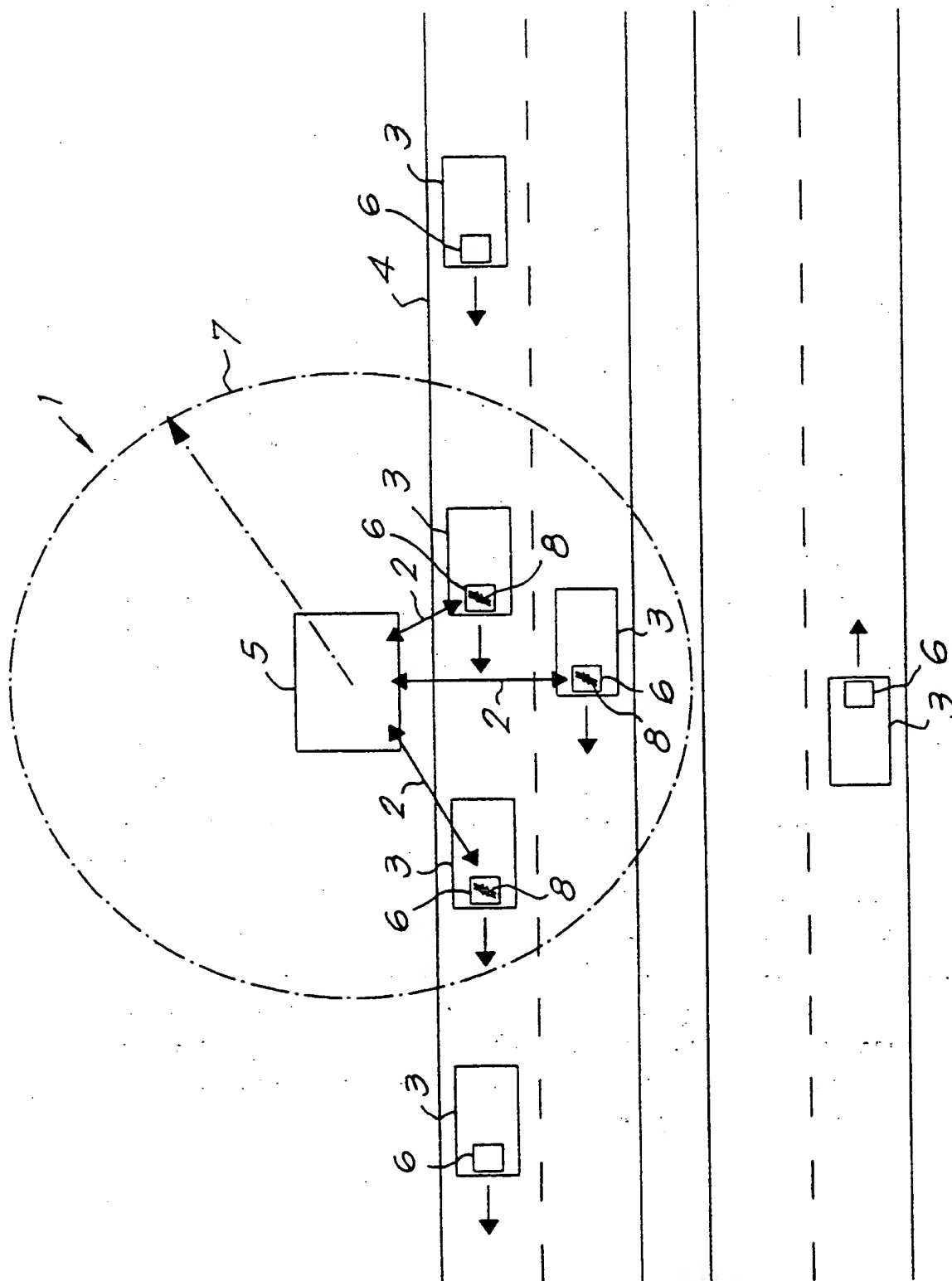
characterized in that the content of the communication (2) is secured.

5 6. Method according to claim 5, characterized in that the content of the communication (2) is secured by cryptographically transforming it.

10 7. Method according to any of the preceding claims, characterized in that the communication equipment (5) erected along the road (4) is mobile.

15 8. Method according to any of the preceding claims, characterized in that it is used for transmitting data during toll driving.

20 9. Device for realizing the method of claim 1, characterized in that it consists of the combination of a multiple of modules (6) which are to be build in and/or are built in respectively in vehicles (3) on the one hand, and communication equipment (5) which is erected and/or can be erected along the road (4) on the other hand, whereby these modules (6) and this communication equipment (5) is provided with electronics which make it possible for the communication equipment (5) to  
25 communicate with the modules (6) situated within the transmission and receiving range (7) of this communication equipment (5) by means of a wireless connection at short distance, such by means of a communication (2) making use of the "direct sequence  
30 spread centrum" principle, also called "direct access broad spectrum" principle.



# INTERNATIONAL SEARCH REPORT

National Application No.

PCT/BE 98/00071

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 6 G08G1/017 G08G1/0967 G07B15/00

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G07B G07C G08G H04B H04J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 89 04093 A (NYSEN PAUL A ; TOBIAS RAPHAEL (AU)) 5 May 1989 see abstract; claims; figures see page 1, line 25 - page 3, line 14 see page 10, line 17 - page 12, line 31 see page 39, line 1 - line 7 see page 53, line 3 - line 22 ---	1-9
Y	US 5 488 631 A (GOLD KENNETH S ET AL) 30 January 1996 see abstract; figures see column 1, line 9 - column 2, line 4 see column 6, line 10 - line 41 --- -/--	1-6,9

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

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